Scordale Mines, Cumbria

[NY 762 226]

Introduction

The Scordale Mines GCR site comprises a number of abandoned surface and underground workings at the head of Scordale, the deep valley of the Hilton Beck, which cuts the Pennine escarpment north of Appleby. The deposits comprise vein and associated flats hosted by Lower Carboniferous limestones which are cut here by the Whin Sill. The mines on the west side of the valley are known as the 'Murton Mines'; the Hilton Mines lie on the east side (Figure 3.6). The GCR site includes only the workings of the Hilton Mines. Both groups of mines were originally producers of lead ore, and in more-recent times barite and some witherite. The mines have long been celebrated for magnificent specimens of yellow fluorite, to be seen in most major mineralogical collections (Symes and Young, 2008). Striking specimens of barite have been obtained, and in recent years fine examples of several nickel minerals have also been collected. Good exposures of the deposits remain *in situ* underground where it is possible to study the detailed mineralogy in its structural and stratigraphical context. Representative specimens are also abundant on the surface spoil-heaps.

The mines were worked by the London Lead Company between 1824 and 1876, during which time over 10 000 tons of lead concentrates were produced. The mines were re-opened in 1896, and under the Scordale Mining Company, and their successors the Brough Barytes Company, produced at least 7200 tons of barite and 70 tons of witherite until their closure in 1919. Subsequent exploration of the workings yielded little if any additional output. The mines today lie within the Ministry of Defence Warcop Training Area and access, both to the surface and underground, is restricted.

Dunham (1948, 1990) provided detailed descriptions of the geology and mineralization of the Scordale deposits, while Young (1998) presented a summary of the geology and mining history. More recently, in a review of replacement mineralization in the Northern Pennines, Bouch *et al*. (2006) have commented on these deposits. Bridges (1982) described a suite of nickel minerals, and the occurrence of supergene minerals at this site has been outlined by Bridges and Young (1998), and Bridges and Green (2005). Raistrick and Roberts (1990) published contemporary photographs of the mines.

Description

Lower Carboniferous (Dinantian) limestones, from the Melmerby Scar up to the Tynebottom Limestone, crop out at the head of Scordale. The Whin Sill, here intruded immediately above the Melmerby Scar Limestone, forms conspicuous dark-grey crags which contrast with the pale-grey limestone scars. Cutting these rocks are several roughly E–W-trending veins, the strongest of which is the Murton Fell North Vein. Several other sub-parallel veins, notably the Middle Vein and the Dow Scar Vein, occur to the south of this and form striking landscape features (Figure 3.7). Most of the veins show evidence of opencast workings, and several levels have been driven into them. Substantial spoil-heaps are associated with most of these workings.

The Scordale veins carry galena in a gangue dominated by barite, fluorite and some quartz. Associated with several of the veins are extensive replacement flat deposits within the Melmerby Scar Limestone. In these the limestone has typically been replaced by the same minerals which fill the veins. The flats, which were the source of most of the economic mineralization worked here, occur at the top of the Melmerby Scar Limestone. The shale, which lies between the limestone and the Whin Sill and which has been baked by this intrusion, forms a sharply defined roof to the flats in many parts of the mines. Dunham (1948, 1990) recorded that the flats were generally up to 1.8 m thick at the top of the Melmerby Scar Limestone. They are locally up to 37 m wide, although average widths are usually around 18 m. A feature of these flats is the abundance within them of cavities lined with well-formed cubic crystals of yellow fluorite, together with tabular white barite which clearly encloses euhedral fluorite. Colourless, pyramidal crystals of quartz also occur but in generally smaller amounts. Galena is also common. Dunham (1990) commented that the mineralization in both the Murton and Hilton mines was generally similar, although with rather more barite and less quartz in the Hilton deposits.

Witherite was found in the Murton Mines and some was worked from a flat known as the 'Carbonate Shake'. A little witherite may be seen today *in situ* in a small area of flat mineralization remaining in the opencast known as 'Mason's Holes', west of Murton Mines, and fragments of this mineral occur sparingly on spoil heaps on the hillside below Masons Holes. Witherite has not been observed in the Hilton deposits. Bridges (1982) described a pocket of niccolite, associated with gersdorffite and millerite in the eastern wall of Dow Scar High Level. Supergene minerals are scarce in the Scordale Mines, although fine specimens of crystallized annabergite were found within the nickel-rich pocket in Dow Scar High Level (Bridges, 1982; Bridges and Young, 1998), and a little aurichalcite and malachite have been observed elsewhere in the mine (Young *et al.,* 1985a).

More recently, Bridges and Green (2005) have reported the occurrence also of adamite, mimetite, smithsonite, anglesite, calcite, hydrozincite, limonite and rosasite from Hilton Mines. For the arsenates adamite and mimetite, this represents the first occurrence of these minerals in the Alston Block of the Northern Pennine Orefield.

Interpretation

The stratigraphical and structural relationships of the veins and associated flats are clearly displayed in the remaining accessible underground workings of Scordale Mines. Whereas some lead ore was worked from stopes in the veins, the main source of economic mineralization lay in the extensive flats. These are widely developed adjacent to most of the Scordale veins. All occur within the top beds of the Melmerby Scar Limestone, immediately beneath the thermally metamorphosed shale which intervenes between the limestone and the Whin Sill. The concentration of abundant flat mineralization at this horizon almost certainly results from the ponding effect of this impervious bed to the upward passage of mineralizing fluids. Dunham (1990) commented on the similar relationship of flat mineralization to the presence of shale or sandstone immediately above the Great Limestone elsewhere in the orefield. Flats may occur where shale immediately overlies the limestone; where sandstone overlies the limestone, flats are typically absent. The available plans and sections of Scordale Mines suggest that mineralization, whether in veins or flats, was mainly concentrated beneath the Whin Sill. The sill, together with its envelope of thermally altered shale, thus appears to have been a very effective barrier to mineralizing fluids.

The Scordale flats, unlike other flats within the orefield, are characterized by the replacement of limestone principally by fluorite and barite, with minor galena and quartz. Elsewhere in the Northern Pennine Orefield ankerite and/or siderite, locally with abundant silica, are the usual replacement minerals. Ankerite and siderite are rare or absent at Scordale.

The abundance of fluorite and barite within the same deposit is a feature of interest at Scordale. Within the zonal pattern of mineralization in the Alston Block portion of the Northern Pennine Orefield, occurrences of fluorite and barium minerals are usually mutually exclusive. In the few instances where fluorite and barite do co-exist, such as Scordale, fluorite invariably pre-dates barite. At Scordale, fluorite and barite occur together in roughly equal proportions within a restricted area towards the distal margin of the outer, barium, zone of the field. The zonation of the orefield, including the major central fluorite zone, has been related to the role of major cupolas on the upper surface of the Weardale Granite at Rookhope and Tynehead acting as channels for mineralizing fluids (Dunham, 1990). The small centre of fluorite-rich mineralization at Scordale may correlate with the presence of an emanative centre of mineralization above a minor concealed granite cupola (Bott and Masson-Smith, 1957; Bott, 1967; Dunham, 1990).

Dunham (1937, 1952b, 1990) drew attention to the distribution of colour within Northern Pennine fluorite, noting that yellow is particularly common in the outer parts of the fluorite zone, further observing that the yellow varieties typically exhibit appreciably lower rare-earth-element contents than the purple and green forms abundantly present within the inner parts of the zone. If the rare earth elements within Northern Pennine fluorite were derived from the Weardale Granite it may be that they were deposited abundantly within the inner parts of the fluorite zone with much lower contents in the outer portion of the zone, including Scordale.

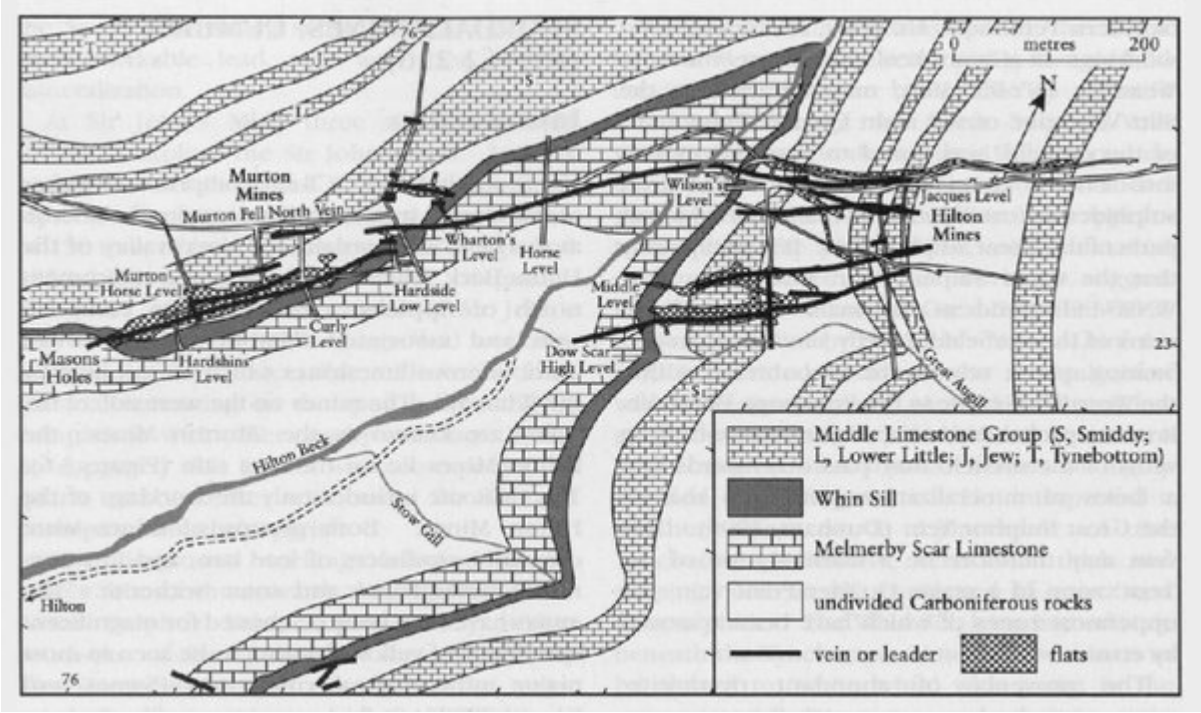
The genetic significance of the co-existence of fluorite and barite at Scordale and the rare-earth-element content of the fluorite, in the overall context of the Northern Pennine Orefield, remain to be fully explored.

The presence of a small concentration of nickel minerals, including niccolite, gersdorffite and millerite, in Dow Scar High Level led Bridges (1982) to speculate on the Whin Sill as a possible source rock. Whereas this cannot be confirmed, it is noteworthy that other concentrations of nickel mineralization within the orefield are also closely associated with this intrusion, such as at the Settlingstones Mine and the Lady's Rake Mine GCR sites (see GCR site reports, this chapter).

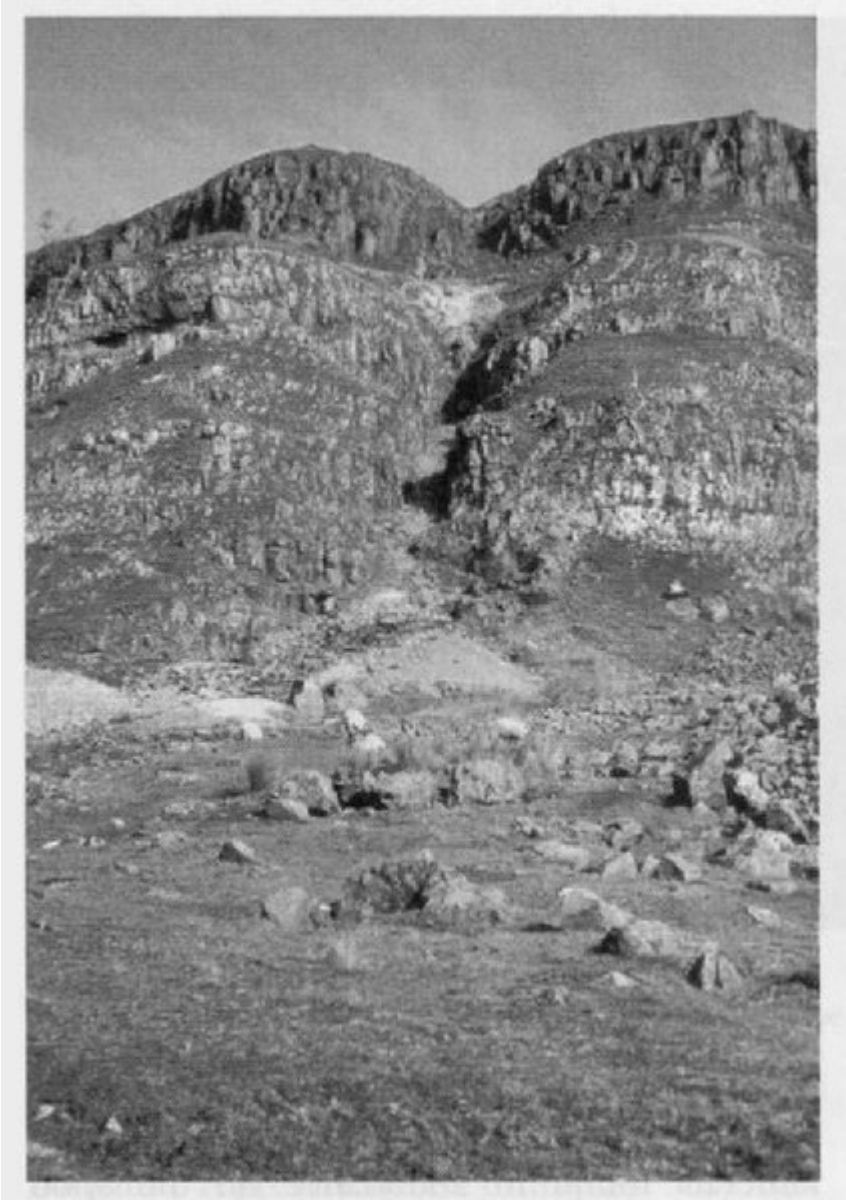
Conclusions

The Scordale Mines GCR site provides excellent dear sections of vein and extensive flat mineralization within the Melmerby Scar Limestone, where the influence of the Whin Sill and its envelope of thermally altered shales in confining mineralizing fluids to the upper beds of the limestone can readily be demonstrated. The abundance of fluorite and barite within the same deposit is an unusual feature within the Northern Pennine Orefield, perhaps related to a cupola on the concealed Weardale Granite. Considerable research scope remains to investigate both the significance of this paragenesis and the presence within the deposit of a small concentration of nickel mineralization.

References



(Figure 3.6) Sketch map showing the main veins and flats at the Scordale Mines GCR site. After Dunham (1990).



(Figure 3.7) Scordale Mines. The Dow Scar Vein here forms a prominent gully crossing the outcrop of the Melmerby Scar Limestone. The dark, upper, crags are composed of Whin Sill dolerite. Dow Scar High Level lies adjacent to the small area of pale-coloured spoil immediately beneath the Whin Sill crags. (Photo: B. Young.)